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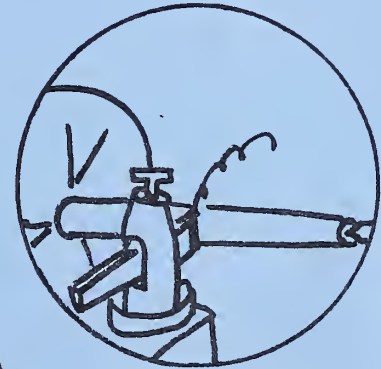
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# MECHANICS

## RELATED MECHANICS



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## A C K N O W L E D G M E N T S

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NOTE: This Curriculum Guide is a service publication only. The Senior High School Program of Studies contains the official statement concerning Senior High School courses. The information contained in the Guide is prescriptive insofar as it duplicates that contained in the Program of Studies. There are in the Guide, however, as well as content, methods of developing the concepts, suggestions for the use of teaching aids and lists of additional reference books.

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## I. INDUSTRIAL EDUCATION

Industrial Education is a program consisting of courses which provide a continuum of experiences, starting with exploratory activities in the junior high school and expanding in the high school to the development of skills related to career fields. This development of the student's skills is planned for through courses in industrial arts and vocational education culminating in on-the-job work experience, or entry into a job or post-high school institution for further education.

The program consists of courses ranging from those designed for an exploration of the technologies and trade areas to units of practical preparation for a career. In the process, the courses develop the student's knowledge of himself, his talents and his skills.

The Industrial Education course "guides" provide the teacher with an outline of the topics, generalizations and concepts selected as most relevant for the physical and mental development of the students and the logical development of the subject area in accordance with the resources of the school in both teaching personnel and facilities.

The Guide leaves much scope for the teacher to develop content related to the topics, especially in writing behavioral objectives describing specific changes in student behavior anticipated from the learning tasks.

It is expected that each school district will develop a program of Industrial Education appropriate to the fulfilment of the needs of its student clientele.

## II. OBJECTIVES

### A. Industrial Education Objectives

The general objectives of Industrial Education complement the aims and objectives of the secondary school. The objectives of Industrial Education are to:

1. Develop basic competencies both academically and in work skills to enter either a job or a post-high school institution for further education.
2. Provide courses that serve as a vehicle in helping students relate their academic knowledge to vocational competencies.

3. To provide students the opportunity to develop basic competencies, both academically and in work skills to enter either a job or a post-high school institution for further education.
4. To provide students with the environment whereby they may develop sound attitudes, acceptable work habits, and achieve a feeling of accomplishment.

#### B. Mechanics Career Field Objectives

The Mechanics courses should give students an opportunity to:

1. Obtain exposure to, and a basic understanding of, the career field.
2. Develop the basic skills and knowledge to gain job entry or articulation with post-high school institutions.
3. Develop a standard of craftsmanship acceptable to the trade and to himself.

#### C. Major Area of Study Objectives

The related mechanics courses should give students an opportunity:

1. to practice analytical thinking related to problems of mechanics.
2. to develop technical knowledge, attitudes and skills required in the various modules of Related Mechanics.
3. to work with a variety of tools, materials and pieces of equipment in a correct and safe manner.

### III. EVALUATION

Evaluation of student growth should be based on stated behavioural changes and specific criteria understood by the students. Allowance should be made for both self and teacher evaluation and in some cases peer evaluation. Evaluation should be further based on the three domains of learning as defined by an Alberta committee of Industrial Education teachers. Their categories are as follows:

- a. Verbal and Written Communication
- b. Personal Growth
- c. Manipulative Skills.

The weighting given each of the three measures will depend on the nature of the behaviour being evaluated. For a more detailed treatment of evaluation see the Industrial Education Handbook.

#### IV. ORGANIZATION

##### A. Guide Organization

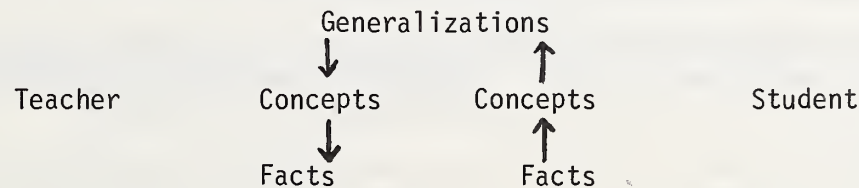
The course guides are developed on the following pattern:

1. Topic: Each course is subdivided into a number of topics.
2. Generalization: The main generalization or "big" idea that students should learn follows each topic.
3. Concepts: The concepts divide the topic into the teaching components. They give more direction on specific areas that should be studied.
4. Behavioural Objectives: These describe specific changes in student behaviour which result from the learning tasks he performs.

The guide gives only a few sample behavioural objectives. It is the responsibility of the teacher to develop as many behavioural objectives as he can teach in the time available.

Facts are taken to be items of specific information, concepts are categories of information, and generalizations express the relationship between concepts.

In planning a lesson, the teacher moves down this hierarchy, whereas in learning, the student begins with facts and moves upward.



5. Suggested Activities: A few suggestions are made as to the types of activities that could be used to achieve the behavioural objectives.

6. Resource Materials: This column suggests where materials may be obtained.

## B. Program Organization

### 1. Program Description

The Related Mechanics modules give students the opportunity to learn the theory and skills necessary in the related mechanics. They will learn to identify and use hand and power tools to perform the major processes, analyses and repair work required. Their projects can include activities ranging from forming for concrete, drawing plans, machining parts to building a farm building. In the process, they will learn about the trade, job opportunities, business practices, and enough skills to get a job, go into apprenticeship or otherwise enhance their avocational interests.

### 2. Organization of Majors

The major is divided into seven five-credit modules. Entry into the major is through Mechanics 12, Industrial Education 10, Machine Shop 12 or Welding 12. The second and third level modules ("22" and "32") are non-sequential and can be taken in any order with the exception of Related Mechanics 32C.

32C is the last course in the 35 credit sequence and can be used to:

- a. provide greater depth to a module taken previously.
- b. gain experience in an actual job under a work plan whereby the Related Mechanics teacher coordinates the student program. The student must be under the supervision of a journeyman while on the job.

In addition to the modules set out in the major for Related Mechanics, a student may select modules designated as minors. These are normally the first level or introductory course of the area. The module in Drafting would be Drafting 12.

Some students may desire to take only a few modules in a major area as a supplement to their academic program or they may broaden their selection to other career fields. The scope of the Industrial Education program allows the flexibility necessary for the program to be tailored to meet the interests and needs of the individual class or student.

The chart on page 6 gives a graphic description of the Related Mechanics program. Each module is identified and the sequences are indicated by lines. E.g. After a student has completed one of Mechanics 12 or Industrial Education 10 he/she may advance to any module to which the solid line leads; in this case any of 22A, 22B, 22C, 32A or 32B. All modules in the sequence must be completed before advancing to 32C.

Once a student has enrolled in a "22" or second level course, he may also select modules from a minor field. Minors for which grants are available are listed on the chart.

Students may find some of the courses in the listed related fields beneficial to their career program development. They are encouraged to take them even though these related courses are not supported by special grants.

### 3. Facility Organization

The organization of the physical facilities is in part determined by the original plan. There are however adjustments that can be made in the layout by the teacher to accommodate his/her style of teaching. The number of students in a class affects the way the lab or shop is organized. While most of the shops in Alberta are designed for 16 to 20 students, a number of factors must be considered in the final assignment of class load. These factors include:

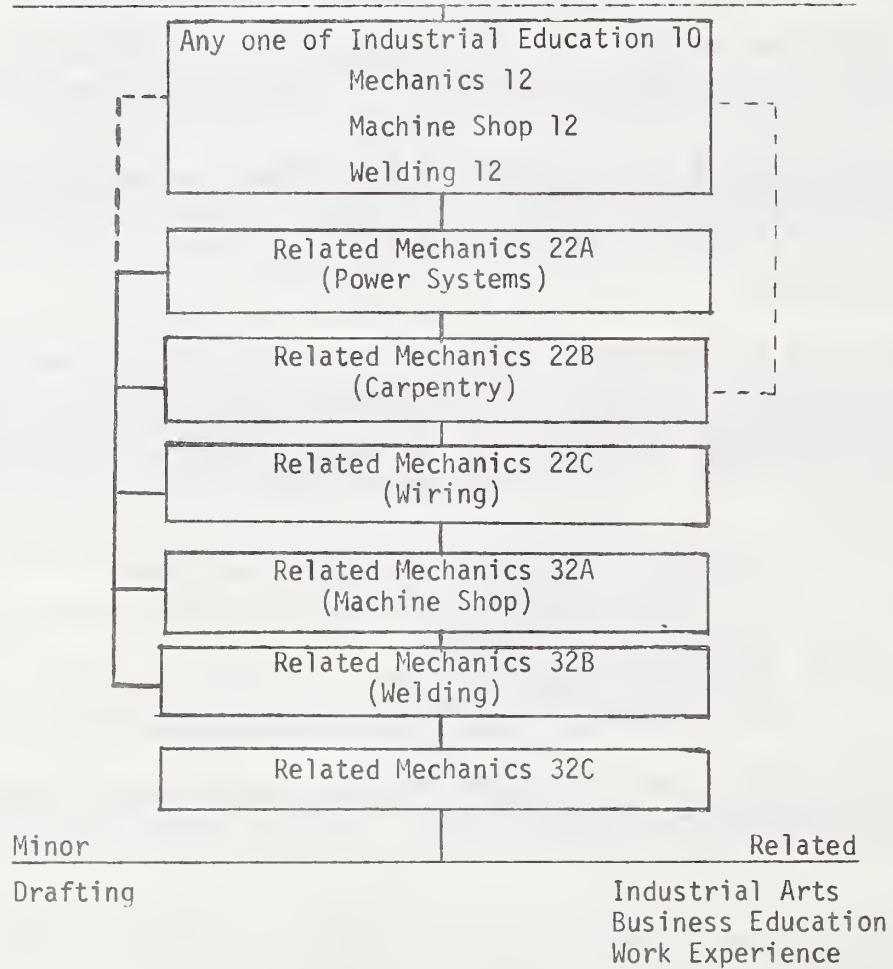
1. physical size of the shop or laboratory
2. type of student
3. amount of equipment
4. type of programming
5. type of course
6. training and experience of the teacher.

Safety of the students and their opportunity to obtain teacher contact are important considerations when class loads are determined.

CAREER FIELD

MECHANICS

Related Mechanics



## V. CAREER OPPORTUNITIES

Students taking all or most of the modules in the Related Mechanics major may look forward to the following opportunities:

## Related Mechanics

Post High School Studies

Career Entry

N.A.I.T., S.A.I.T.

Building Construction Technology  
 Pre-Technology  
 Agricultural Mechanic  
 Welding

Apprenticeship  
 Journeyman Agricultural  
 Mechanic  
 Partsman  
 Farmer

UNIVERSITY

Teacher  
 Agriculturalist





VI. RELATED MECHANICS

1. Mechanics 12



## INTRODUCTION

Mechanics is the study of the sources and transmission of power. Through the reading and activities the student will engage in as he progresses through these units of study, he will gain a concept of work, energy and power. The course itself is not intended to provide trades training but rather to introduce the student to the broad scope of energy sources, its transmission and its application.

Testing and analysis, reading and research, practice and demonstration makes up the core of the program.

### I. OBJECTIVES

The specific objectives of Mechanics 12 are:

1. To help the student understand the many basic laws and principles of science at work in Mechanics, and relate these laws and principles to the vast area of power technology.
2. To allow the student to gain an insight into the construction and requirements of machines which convert energy to useful work.
3. To enable the student to understand the use, care and control of the power machine.
4. To provide the student with realistic experiences so that he is better able to make a career choice based on accurate information.

### II. CONTENT SUMMARY

1. Career field study
2. Safety
3. Shop practices
4. Automobile Care and Ownership
5. Power Sources
6. Power Plant Systems
7. Transmission of Power
8. Fluiding (optional)

## III. REFERENCES

Section I

\*Duffy, Joseph W. *Power - Prime Mover of Technology*. General Publishing, 1972.

\*Nash, Frederick C. *Automotive Fundamentals*. McGraw-Hill, 1969.

Crouse, Wm. H. *Automotive Mechanics*. (6th ed.) McGraw-Hill, 1970.

*Engine Charts and Plans*. Available from:

General Motors Ltd., Department of Public Relations, Oshawa, Ontario;

Ford Motor Company, Education Affairs Department, The American Road, Dearborn, Michigan, 48121;

International Harvester Company Ltd;

Chrysler Corporation Ltd., Community Affairs Department, Box 1919, Detroit Michigan, 48231;

Caterpillar Tractor Company.

Films. Shell Oil Company of Canada Ltd.

Purvis, Jud. *All About Small Gas Engines*. General Publishing, 1960.

Purvis, Jud and Wm. K. Toboldt. *Motor Services Automotive Encyclopedia*. Goodheart - Wilcox.

Service Bulletins and Charts. Available from:

-Chrysler Corporation

-Delco Remy Company Ltd., Division of General Motors, Aderson, Indiana

-Ford Motor Company

-General Motors Ltd.

*Short Stories of Science and Invention*. General Motors Manuals. General Motors Products of Canada, Service Promotion Department, Oshawa, Ontario.

Stephenson, George E. *Power Mechanics*. Delmar.

Stockel, M. W. *Auto Service and Repair*. Goodheart-Wilcox, 1969.

Benk, E. and W. Billiett. *Automotive Fundamentals*. American Technical Society.

\* Most Used.

Section II

- Atkinson, Henry. *Mechanics of Small Engines*. McGraw-Hill of Canada.
- Beeler, Samuel C. *Understanding Your Car*. (2nd edition) McKnight and McKnight.
- MacDonald, K. L. *Small Gasoline Engines, Student's Workbook*. Thomas Allen and Sons.
- McGuffin, M. J. *Automotive Mechanics*. Macmillan, 1973.
- Pipe, Ted. *Small Gasoline Engines Training Manual*. (2nd edition) Thomas Allen and Sons.
- Stewart, Henry L., and John M. Stores. *Fluid Power*.
- Worthington, Marquillis and Crouse. *General Power Mechanics*.
- Hydraulic Power*. Laboratory Manual for Vega Hydraulic Power Training Unit.
- Pneumatic Power*. Laboratory Manual for Vega Pneumatic Power Training Manual.
- Principles of Engine Analysis*. Go-Power Systems
- Small Engines Service Manual*. Technical Publications, A.C. Simmonds & Sons Ltd., 285 Yorkland Boulevard, Willowdale, Ontario.

## IV. CONTENT

Generalizations, concepts and behavioural objectives are outlined on the following pages. Teachers are expected to develop additional behavioural objectives and activities to supplement the identified content and maintain relevancy.

Career Field: Mechanics

Topic 1: CAREER FIELD STUDY

Major: Automotives

Generalization A: There are many occupations within and related to the field of Mechanics.

Course: Mechanics 12

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Career Field Occupations  2. Employment Opportunities - local - regional - national  3. Trade Certification		The student will:  a. make a survey of the various occupations available in the career field and list the entry requirements.  b. list courses in his school system that lead to his career choice.  a. discuss employment opportunities in the Mechanics career field.  a. explain journeyman certification requirements and articulation with the Apprenticeship Branch.	Outside speakers. Tours. Guidance Counsellor.	

Notes:

Topic II: SAFETYGeneralization B: A knowledge and practice of safety is essential in all shop activities.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Unsafe Act		The student will: <ol style="list-style-type: none"> <li>a. list the consequences of unsafe acts particularly relating to:               <ul style="list-style-type: none"> <li>- hoists</li> <li>- jacking devices</li> <li>- compressed air</li> <li>- eye injury</li> <li>- hand tools</li> <li>- power equipment</li> <li>- welding equipment</li> <li>- lifting.</li> </ul> </li> </ol>		
2. Unsafe Conditions		<ol style="list-style-type: none"> <li>a. list unsafe conditions which could lead to injuries.</li> </ol>		
3. Accident Reporting		<ol style="list-style-type: none"> <li>a. explain purpose and use of accident report forms.</li> </ol>		
4. Compensation		<ol style="list-style-type: none"> <li>a. explain the function of and benefits available under the Workmen's Compensation Act.</li> </ol>		Workmen's Compensation Study outline by Max Grant, Drumheller.
5. First Aid		<ol style="list-style-type: none"> <li>a. clean and bandage a cut.</li> </ol>		

Notes:





Topic IV: AUTOMOBILE CARE AND OWNERSHIP

Generalization D: Efficient maintenance and control of each power device is important to the function of the total unit or system.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Body and Chassis Maintenance		The student will: a. polish a car. b. remove stains such as: - grease or oil - fruit - blood - lipstick - milk		
2. Tool Use		a. use the automotive hand tools correctly.		
3. Lubrication		a. explain how the engine is lubricated. b. lubricate a whole car using the appropriate oils and greases.		
4. Maintenance Inspections		a. make on the spot checks for: - body damage - tire wear - shocks - oil and water leaks - hardware, cushions, glass, steering wheel play.	Discuss car condition. Have students inspect each other's cars and write reports on their findings.	

Notes:

Topic X: AUTOMOBILE CARE AND OWNERSHIP (Continued)Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
		b. make a thorough inspection prior to a long trip by checking: <ul style="list-style-type: none"> <li>- body</li> <li>- electrical system</li> <li>- ignition</li> <li>- horn</li> <li>- lights</li> <li>- generator</li> <li>- battery</li> <li>- tires               <ul style="list-style-type: none"> <li>air pressure</li> <li>wear and condition</li> <li>spare</li> </ul> </li> <li>- fuel system               <ul style="list-style-type: none"> <li>pump</li> <li>carburetor</li> <li>air cleaner</li> </ul> </li> <li>- cooling system               <ul style="list-style-type: none"> <li>water level</li> <li>anti-freeze</li> <li>fan belt</li> <li>hose conditions</li> </ul> </li> <li>- drive system               <ul style="list-style-type: none"> <li>clutch pedal (free travel)</li> <li>transmission oil level</li> <li>differential lubrication level</li> </ul> </li> </ul>	Perform various inspections and tests.	

Notes:

Topic X: AUTOMOBILE CARE AND OWNERSHIP (Continued)Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
5. Insurance		<ul style="list-style-type: none"> <li>- power plant</li> <li>  oil level</li> <li>  oil color</li> <li>- running gear</li> <li>  brakes, hand brake</li> <li>  shock absorbers, front</li> <li>  wheel bearings.</li> </ul> <p>a. read an insurance policy and list the coverage on:</p> <ul style="list-style-type: none"> <li>- property damage</li> <li>- body injury liability</li> <li>- collision and upset</li> <li>- comprehensive</li> <li>- medical payments</li> </ul> <p>b. calculate the cost of insurance for adult driver and extra costs for under 25 year old driver.</p>		

Notes:



Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
iii) Types -external  -internal		The student will:  a. identify and analyze the operation of a steam engine.  b. explain the theory of the internal combustion engine.		

Generalization F: Power plants consist of a number of interrelated systems.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Fuel system i) Fuel pump  ii) Carburetor		The student will: a. given a fuel pump: i) explain how it operates ii) clean fuel filter  b. given a carburetor: i) explain how it works ii) explain the difference between various types: -single barrel -two barrel -four barrel iii) dismantle and assemble units iv) adjust a carburetor v) adjust automatic choke vi) discuss methods of increasing gas mileage.	Dismantle and examine several types of fuel pumps.  Study cut-away models. Test fuel pump pressure.	
2. Exhaust System		a. list the dangers of a leak in the exhaust system.  b. check the condition of: -exhaust pipe -muffler -tail pipe		
3. Cooling System		a. explain the need for a cooling system.  b. list the parts and their functions.	Study charts, slides and models.	

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
4. Lubrication System i) oil pump  ii) filtering system  iii) oil  iv) crank case ventilation		c. discuss the uses and types of anti-freeze solutions.  d. test anti-freeze for strength.  e. examine an air-cooled engine design.  a. given an oil pump: i) explain how it operates b. given an oil filler: i) explain its function ii) replace an oil filter on a car c. classify oils used -change oil in an engine  d. identify the parts of the ventilating system and service.		

TopicGeneralization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
5. Electrical System i) The Lead-Acid Battery  ii) The Generator  iii) Generator Controls  iv) The Starter		The student will: a. given a battery: (i.) identify the parts and materials (ii.) test the battery (iii.) prepare it for charging.  a. given a generator: (i.) list the parts (ii.) describe its operation (iii.) compare A.C., D.C. and three-brush generators (iv.) describe shunt type.  a. describe the function of: (i.) cut-out relay (ii.) voltage regulator (iii.) current regulator.  a. given a starting motor to dismantle:  (i.) name the parts (ii.) describe the principle of operation.	Test a battery and then charge it. Film and Slides. Dismantle a Generator.	

Notes:



Topic VII: TRANSMISSION OF POWER

Generalization G: The transmission of power can be accomplished through fluid or mechanical means.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. Hydraulic Systems</p> <p>(i.) Systems</p> <ul style="list-style-type: none"> <li>- steering</li> <li>- brakes</li> <li>- transmission</li> <li>- hydraulic jack</li> <li>- shock absorber</li> <li>- air-oil suspension</li> </ul> <p>(ii.) Components</p> <ul style="list-style-type: none"> <li>- valves</li> <li>- motors</li> </ul> <p>2. Mechanical</p> <p>i) Power Train</p> <ul style="list-style-type: none"> <li>a) Gears</li> <li>b) Drive shaft</li> <li>c) Clutch</li> <li>d) Differential</li> </ul>		<p>The student will:</p> <ul style="list-style-type: none"> <li>a. study Pascal's Law and explain the relationship of pressure, movement and area.</li> <li>b. explain how a hydraulic jack operates.</li> <li>c. explain the operation of a shock absorber.</li> <li>d. discuss the operation of an air-oil suspension system (hydropneumatic).</li> <li>a. describe the use of remote control valves such as the solenoid valve.</li> <li>b. explain the operation of the following types of hydraulic motors: <ul style="list-style-type: none"> <li>- vane</li> <li>- gear</li> <li>- radial</li> </ul> </li> <li>a. given model kits, assemble and explain the theory and principles of the function of gears and levers.</li> </ul>		

Topic VIII: FLUIDICS (Optional)

Generalization H: The field of Fluidics has added a whole new family of control devices.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Performance Characteristics		The student will:		
		a. make a list of the similarities between hydraulics, pneumatics, electronics and fluidic devices and their performance characteristics.		
2. Symbols		a. given a chart of fluidic symbols, correctly label each symbol.		
3. Coanda Effect		a. given a schematic diagram of bistable element, explain in writing the Coanda principle.		
4. Flip-flop Device		a. given a wall attachment bistable element, connect it to a pressure source and compare its output to a similar device.		
5. Or/nor Device		a. given an or/nor device, correctly connect it to a pressure source and compare its output to a flip-flop device.		
6. And/nand Device		a. given an and/nand device, correctly connect it to a pressure source and compare its output to a flip-flop and or/nor device.		

Notes:

Topic VIII: FLUIDIC (Optional) (Continued)Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
7. Proportional Amplifier		a. given a proportional amplifier, connect it to a pressure source and compare its pressure output to its pressure input.		
8. Vortex Amplifier		a. given a vortex amplifier, connect it to a pressure source and thereby use it to restrict and reduce larger primary flows.		
9. Control Systems		a. given several fluidic devices, construct a prescribed circuit and evaluate its performance.		
10. Fluidic Computers		a. given several fluidic devices, construct a prescribed circuit and perform a simple computer operation.		
11. Accessories		a. if time permits, study resistors, capacitors, relays, read-out devices and sensing devices and their operation.		

Notes:



VI. RELATED MECHANICS

2. Related Mechanics 22A

(Power Systems)



## INTRODUCTION

The Related Mechanics 22A course is oriented to the internal combustion engine. Teachers of Related Mechanics may utilize various types of engines ranging from small motors to tractor diesels in their demonstrations and work assignments.

### I. OBJECTIVES

The objectives of Related Mechanics 22A are to:

1. develop in the students the habits of critical thinking in the analysis of engine problems.
2. accustom the students to utilize manufacturers' manuals and a variety of technical publications.
3. familiarize the student with automotive engines, and thus relate his theoretical background to engine repair.
4. provide the student with a basis for further study into power systems at a more advanced level.
5. develop in the student some of the attitudes and skills required of a motor mechanic.

### II. CONTENT SUMMARY

1. The internal combustion engine
  - construction and operation
2. The maintenance and repair of the internal combustion engine
  - disassembly procedure
  - engine assembly
  - tune-up
3. Engine cooling and lubrication
  - the heat engine
  - waste control

## III. REFERENCES

The following books may be used as references. Those marked with an asterik (\*) are considered most helpful.

- \* Stockel, M.W. *Auto Mechanics*. General Publishing.
- \* Stockel, M.W. *Auto Service and Repair*. Goodheart - Wilcox, 1969.
- Toboldt, W.K. and Johnson, L. *Motor Service's Automotive Encyclopedia*. Goodheart-Wilcox Co.
- Venk, E., and Billiett, W. *Automotive Fundamentals*. American Technical Society.
- Crouse, W. *Automotive Mechanics*. (6th ed.) McGraw-Hill, 1970.
- \* Most useful.

## IV. CONTENT

Generalizations, concepts and behavioural objectives are outlined on the following pages. Teachers are expected to develop additional behavioural objectives and activities to supplement the identified content and maintain relevancy.

The allocation of time to each topic, the order of presentation and the inclusion of enrichment materials should meet the needs of the class.



Topic I: THE INTERNAL COMBUSTION ENGINE

Major: Related  
Mechanics

Generalization A: All internal combustion engines are basically similar in theory, design and maintenance.

Course: 22A  
(Power Systems)

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. The Construction and Operation of Automotive Engines is Based on Scientific Principles.</p>		<p>The student will:</p> <ul style="list-style-type: none"> <li>a. relate the concepts of the molecular theory of matter, atmospheric pressure and energy to:                             <ul style="list-style-type: none"> <li>(i.) value motion</li> <li>(ii.) the four-stroke cycle</li> <li>(iii.) the factors affecting power output</li> <li>(iv.) the efficiency of the engine</li> <li>(v.) engine horsepower.</li> </ul> </li> <li>b. investigate the relationship and function of the engine components.</li> <li>c. investigate and compare a variety of engine designs, their construction and operation.</li> </ul>		

Notes:

Topic II: THE MAINTENANCE AND REPAIR OF THE INTERNAL COMBUSTION ENGINE 30

Generalization B: The internal combustion engine requires the adjustment or replacement of parts to maintain peak performance and economy.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. An Ordered Sequence of Engine Dis-assembly Procedures and Parts Storage will Facilitate Component Inspection, Cleaning and Measurement</p> <p>(i.) An engine is composed of parts which may not be inter-changed.</p> <p>(ii.) Thorough cleaning is required before an accurate inspection and measurement can be obtained.</p> <p>(iii.) An accurate inspection depends on a thorough knowledge of measuring devices.</p>		<p>The student will:</p> <p>a. given an engine to disassemble, follow:</p> <p>(i.) the manufacturer's recommendations</p> <p>(ii.) a logical sequence of sub-assemblies.</p> <p>b. given an engine:</p> <p>(i.) analyse engine deposits</p> <p>(ii.) employ correct cleaning procedures on components.</p> <p>c. given an engine:</p> <p>(i.) use measuring tools with care</p> <p>(ii.) analyse the variety of engine problems encountered.</p>		

Notes:

Topic II: THE MAINTENANCE AND REPAIR OF THE INTERNAL COMBUSTION ENGINE (Continued)

Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>2. Engine Assembly</p> <p>(i.) Engine assembly procedures are initiated by correct sub-assemblies.</p> <p>(ii.) Lubricants are required for many of the mating surfaces.</p> <p>(iii.) Safety factors must be considered during installation.</p>		<p>a. determine the size, fit and clearance of engine components.</p> <p>b. employ a variety of testing devices to determine and isolate engine problems, and correct these problems.</p>		
<p>3. Engine Tune Up</p>		<p>a. investigate the visual and mechanical tests required to tune an engine to its specified performance.</p> <p>(i.) battery and cables</p> <p>(ii.) cranking motor and circuit</p> <p>(iii.) engine mechanical condition</p> <p>(iv.) spark plugs</p>		

Notes:

Topic II: THE MAINTENANCE AND REPAIR OF THE INTERNAL COMBUSTION ENGINE (Continued)

Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
		(v.) distributor and ignition circuit service (vi.) manifold and emission system service (vii.) carburetor and fuel system service (viii.) charging system (ix.) general vehicle inspection.		

Notes:

Topic III: ENGINE COOLING AND LUBRICATION

Generalization C: An internal combustion engine to function efficiently must operate within a limited temperature range and so must have means of dissipating heat produced by friction.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. The Internal Combustion Engine is Defined as a Heat Engine.</p> <p>2. Waste Control</p> <p>(i.) Blow-by gases from the crankcase account for 20% of the unburned hydrocarbons released from the automobile</p> <p>(ii.) Exhaust gases account for 60% of the unburned hydrocarbons released from the automobile.</p>		<p>The student will:</p> <p>a. investigate the forces of friction in an engine, analyse their effects, and determine the methods of control.</p> <p>b. investigate the control of heat transfer and dissipation in the engine.</p> <p>c. determine the methods of sealing the cooling and lubricating systems.</p> <p>a. diagnose crankcase emission systems</p> <p>(i.) open PCV systems  (ii.) closed PCV systems  (iii.) PCV valve operation  (iv.) dual action valve  (v.) practical check of PCV systems  (vi.) testing PCV systems  (vii.) servicing PCV systems.</p> <p>b. diagnose exhaust emission systems:</p> <p>(i.) controlled combustion system</p>		

Notes:

Topic III: ENGINE COOLING AND LUBRICATION (Continued)Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>(iii.) The fuel tank and the carburetor permit evaporation which accounts for 20% of the unburned hydrocarbons released from the automobile.</p>		<p>(ii.) Ford improved combustion system            (iii.) air injector reactor system            (iv.) thermactor system            (v.) air guard system            (vi.) Chrysler cleaner air package.</p> <p>c. service fuel systems:</p> <p>(i.) thermal-expansion volume tanks            (ii.) vapor-liquid separator            (iii.) pressure-vacuum relief cap.</p>		

Notes:

VI. RELATED MECHANICS

3. Related Mechanics 22B

(Carpentry)

## INTRODUCTION

The carpentry section of Related Mechanics emphasizes house framing. However the application of this theory and practice involved can readily be applied to other projects related to the farm stead, e.g. granaries, feeders, garages, barns. Students should learn how to use the materials and tools efficiently in accordance with recognized building practices.

## I. OBJECTIVES

The purpose of Related Mechanics 22B (Carpentry) is:

1. to give students practical experience with the tools and materials used to construct buildings
2. to give students a basic knowledge of various types of framing and layout procedures in accordance with approved construction practices.

## II. CONTENT SUMMARY

1. Introduction to Tools and Materials
  - design
  - materials
  - processes
  - tools
2. Introduction to Concrete Form Construction
  - foundations and footings
  - design
  - soils
3. Form Construction
4. Making Concrete
5. Floor Support Framing
6. Floor Framing
  - layout
  - construction
  - sheathing
  - bracing



7. Wall Framing
  - post and beam
  - western platform
  - light frame
  - sheathing
8. Ceiling and Roof Framing
  - ceiling framing
  - roof framing

Material costs may be reduced and students more highly motivated if an actual building, such as a granary or garage, can be prefabricated at school and set up on site.

While the course emphasizes house construction, the teacher should feel free to apply the principles taught to farm buildings and other construction projects.

### III. REFERENCES

- Miller, H. G. *Building Construction: Materials and Methods*. Macmillan of Canada, Toronto.
- Canadian Wood-Frame House Construction*. C.M.H.C., Ottawa.
- Supplement No. 5, The Residential Standards - National Building Code*. C.M.H.C., National Research Council, 1968.
- Jones, R.P. *Framing, Sheathing and Insulation*. Delmar Publishers (Canada) Ltd., 140 Birchmount Road, Scarborough, Ontario
- Wass, A. *Building Construction: Roof Framing*. Prentice-Hall, 1960.
- Smith. *Principles and Practices of Light Construction*. Prentice-Hall, 1963.

### IV. CONTENT

Generalizations, concepts and behavioural objectives are outlined on the following pages. Teachers are expected to develop additional behavioural objectives and activities to supplement the identified content and maintain relevancy.



Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
3. Process		The student will: a. perform the basic woodworking processes: - sawing - surfacing - shaping - joinery - fastening	Demonstration of Processes.	
4. Tools		a. classify tools functionally to indicate their purpose and use: - measurement, layout and testing - saws - shaving and paring - boring, drilling and mortising - abrasive - holding and supporting - impelling and percussion  b. use handtools properly, safely and efficiently.  c. care for and maintain tools in good condition.		

Notes:

Topic I: INTRODUCTION TO TOOLS AND MATERIALS (Continued)Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
		<p>The student will:</p> <p>d. observe the general safety rules for operating power tools.</p> <p>e. use stationary and portable power tools safely:</p> <ul style="list-style-type: none"> <li>- saws</li> <li>- planers and jointers</li> <li>- sanders</li> </ul>		

Notes:

Topic II: INTRODUCTION TO CONCRETE FORM CONSTRUCTION

Generalization B: Foundations are essential for all types of structures and must be designed for varying soil conditions.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Foundations and Footings	4 hrs.	<p>The student will:</p> <p>a. group footings into the following types:</p> <ul style="list-style-type: none"> <li>- wall footings</li> <li>- column footings</li> <li>- chimney footings</li> <li>- porch and stair footings</li> <li>- stepped footings.</li> </ul> <p>b. identify the foundation types:</p> <ul style="list-style-type: none"> <li>- T foundation</li> <li>- wall foundation</li> <li>- slab foundation</li> </ul>	Visit to a construction site.	
2. Design		<p>a. identify footing design problems:</p> <ul style="list-style-type: none"> <li>- simple stresses of materials</li> <li>- live and dead loads</li> <li>- transmission of loads to structural supporting members.</li> <li>- depth of footings</li> </ul> <p>b. apply Residential Standards - requirements for footings for house construction.</p>	A study of Canadian Residential Standards.	

Notes:

Topic II: INTRODUCTION TO CONCRETE FORM CONSTRUCTION (Continued)Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
3. Soils		<p>The student will:</p> <p>a. identify the different types of soil conditions encountered in construction and their suitability as bearing surfaces.</p> <ul style="list-style-type: none"> <li>- sand</li> <li>- clay</li> <li>- gravel</li> <li>- rock</li> <li>- land fill</li> </ul>	Tests demonstrating how sand, clay and gravel react when subjected to load conditions.	

Notes:

Generalization C: Forms are required to contain and to support the materials of concrete structures.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Forms	5 hrs.	<p>The student will:</p> <p>a. describe form requirements:</p> <ul style="list-style-type: none"> <li>- size and shape</li> <li>- strength</li> <li>- watertightness</li> <li>- economy</li> </ul> <p>b. identify the materials used in form construction:</p> <ul style="list-style-type: none"> <li>- wood</li> <li>- plywood</li> <li>- metals</li> <li>- earth</li> <li>- patented form ties</li> <li>- sectional forms.</li> </ul> <p>c. apply the CSA Standards for:</p> <ul style="list-style-type: none"> <li>- form design</li> <li>- form construction</li> <li>- stripping and re-use of forms</li> </ul> <p>d. describe the function of each member of concrete forms by stating their requirements and relations</p> <ul style="list-style-type: none"> <li>- shoe, plate</li> <li>- stud</li> </ul>	Build a section of footing forms.	

Notes:

Topic III: FORM CONSTRUCTION (Continued)Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
		<ul style="list-style-type: none"> <li>- waler</li> <li>- ties</li> <li>- spreader</li> <li>- brace</li> <li>- stake</li> </ul> <p>e. explain the principles and methods for building:</p> <ul style="list-style-type: none"> <li>- concrete walks.</li> <li>- concrete driveways and patios</li> <li>- floors.</li> </ul> <p>f. apply Residential Standards requirements for water-proofing and dampproofing of floors and walls below grade.</p>	Provide for project in walks etc.	

Notes:



Generalization D: Concrete as a durable material is used extensively for varied building purposes.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Concrete - a Building Material	10 hrs.	The student will: <ul style="list-style-type: none"> <li>a. define concrete.</li> <li>b. summarize the fundamental facts about concrete:                             <ul style="list-style-type: none"> <li>- range of proportions of materials used in concrete.</li> <li>- essential requirements of concrete.</li> <li>- relationship in concrete.</li> </ul> </li> <li>c. outline the utility and possibilities of concrete construction.</li> </ul>	Research assignment to acquaint himself with current trends.	

Notes:



Generalization F: Accurate layout and construction of the floor frame is essential in quality building.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. Layout</p> <p>2. Construction</p> <p>3. Sheathing</p> <p>4. Bracing</p>		<p>The student will:</p> <p>a. given accepted joist spacings, select the proper type and size of material to suit each spacing according to Residential Standards.</p> <p>a. using full-sized materials, set up a section of a floor frame including floor openings, bridging joist hangers, blocking, etc., according to accepted practice.</p> <p>a. compare the strength, nail-holding power, application time, and cost of various subfloors.</p> <p>a. describe cross bridging, strap bridging, and solid bridging.</p> <p>b. find examples of metal bridging.</p>		

Notes:

Topic VII: WALL FRAMING

Generalization G: There are three basic types of framing used in Canada (Post & Beam, Balloon and Western Platform). Western Platform is almost exclusively used in Alberta today.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Post and Beam		<p>The student will:</p> <ol style="list-style-type: none"> <li>a. explain the basic design of post and beam framing.</li> <li>b. state some of the advantages and disadvantages and how it differs from Western Platform.</li> </ol>	<p>Field trips could be arranged; blueprints could be studied and discussed.</p>	
2. Western Platform		<ol style="list-style-type: none"> <li>a. discuss the advantages and disadvantages of Platform framing.</li> <li>b. lay out plates, calculate lengths of studs, cripples, trimmers, thicknesses and depths of lintels and beams, and lay out for openings in floor and walls.</li> <li>c. read and interpret various tables in the Residential Standards.</li> </ol>	<p>If possible, a garage or granary can be framed. It will be built as theory, drafting, and shop drawing progress. Elevation and cross section draftings of framing should be made.</p>	
3. Special Light Frame Construction		<ol style="list-style-type: none"> <li>a. examine pictures or models of more recent types of light frame construction such as A-frame and Rigid frame.</li> <li>b. list advantages and disadvantages of each type.</li> </ol>	<p>Scale model of these types could be constructed by students to use as examples. A small cottage of either of these types could be built in the shop.</p>	

Notes:

Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
4. Sheathing		The student will:  a. examine several types of wall sheathing used and the proper application of each type.	A cross section drafting of each type should be done by each student.	

Notes:

Generalization H: Skillful construction of the ceiling and roof unit adds strength to, and reduces movement and noise of, a frame building.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. Ceiling Framing</p> <p>2. Roof Framing</p> <p>(a) Types</p> <p>(b) Terminology</p> <p>(c) Regulations</p> <p>(d) Construction</p> <p>(e) Sheathing</p>		<p>The student will:</p> <ol style="list-style-type: none"> <li>a. select thickness and width for ceiling joists and beams to suit various spans.</li> <li>a. describe various roof types built and will identify the type most commonly used in Alberta.</li> <li>b. memorize terminology used in roof-construction.</li> <li>c. explain the relationship between the terms <u>rise</u>, <u>run</u>, and <u>line length</u>.</li> <li>d. determine the proper widths of rafters for the various spacings and spans using the Residential Standards code.</li> <li>e. erect and nail a roof frame in place, according to good building practice and regulations.</li> <li>f. close in a roof cornice.</li> </ol>		

Notes:

Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>3. Special Ceiling/ Roof Framing (optional)</p>		<p>The student will:</p> <ul style="list-style-type: none"> <li>g. examine and describe the various types of sheathing used for covering a roof frame.</li> <li>h. apply and fasten roof sheathing to comply with the Residential Standards and good building practice.</li> <li>i. use various types of fasteners used in Alberta.</li> <li>a. describe a variety of roof trusses used for different spans and the limitations of each type of truss.</li> <li>b. explain several methods of building trusses and the reasons for building a certain type of truss.</li> </ul>	<p>Students should design and build model trusses of a King Post truss, a W or Fink truss, a Long Span truss, a Scissors truss, a Bowstring truss, and a Flat Roof (or Floor) truss.</p> <p>If practical, students should make a set of trusses for an actual building with a gable roof.</p>	

Notes:

## INTRODUCTION

This course introduces the student to basic wiring. Introductory work in electrical theory would be beneficial but is not mandatory. While the course is written with emphasis on house wiring, the teacher should use his discretion in applying the concepts and procedures to wiring farm buildings and motor hook-ups.

## I. OBJECTIVES

The objectives of Related Mechanics Electricity is to:

1. introduce the student to concepts of electrical wiring in the home.
2. allow the student to develop skill in the use of tools, equipment, and instruments peculiar to the electrical field.
3. to familiarize the student with the electrical codes and their application.

## II. CONTENT SUMMARY

1. Career opportunities
2. Safety
3. Installation of residential wiring
  - planning
  - tools
  - installation procedures
  - power outlets
  - code requirements
  - special circuits
4. Maintenance of electrical services
  - gas furnace heating controls
  - electric heating
  - rewiring



VI. RELATED MECHANICS

4. Related Mechanics 22C

(Electric Wiring)



5. Management practices
  - organization
  - bidding for work
  - employee concerns.

### III. REFERENCES

#### Prime References

- Graham, U.C. *Interior Electric Wiring*. American Technical Association, Chicago, 6th Ed.
- \* *Canadian Electrical Code*. Current or latest approved edition. C.S.A.
- Lister, E.C. *Electric Circuits and Machines*. McGraw-Hill Ryerson.
- Long F.J. *Intermediate Electricity*. General Publishing, 1965.
- Up-to-date supply catalogues* - G.E., Federal Pacific, Westinghouse, Sylvania, S&S, etc.

### IV. CONTENT

Generalizations, concepts and behavioural objectives are outlined on the following pages. Teachers are expected to develop additional behavioural objectives and activities to supplement the identified content and maintain relevancy.

Topic I: CAREER OPPORTUNITIES IN ELECTRICITY

Major: Related  
Mechanics

Generalization A: A knowledge of the career opportunities in electricity will help the student make a more rational choice of school courses that prepare him for a future job.

Course: 22C (Electric  
Wiring)

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. The Career</p> <ul style="list-style-type: none"> <li>- Residential wiring is only a small facet of the electrical field</li> <li>- Commercial wiring must be taken to be eligible for "time-off" on apprenticeship</li> </ul>		<p>The student will:</p> <ol style="list-style-type: none"> <li>a. investigate the career opportunities in the electrical field by:                             <ul style="list-style-type: none"> <li>- listing the number of jobs available in the home location.</li> <li>- interviewing electrical firms.</li> </ul> </li> <li>b. study the Apprenticeship Act of Alberta and list its requirements.</li> </ol>	<p>Discussion. Career film. Visit by power company official, etc.</p> <p>Lecture/Discussion with aid of government brochures.</p>	

Notes:

Generalization B: Safety is of prime importance to the well being of persons and equipment.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. Unsafe Act</p> <p>2. Unsafe Condition</p> <p>3. First Aid</p>		<p>The student will:</p> <p>a. list the consequences of acts in electricity particularly as they relate to:</p> <ul style="list-style-type: none"> <li>- electric wires</li> <li>- wire loads</li> <li>- pounding procedures</li> <li>- climbing harness</li> </ul> <p>a. discuss how to identify conditions which could lead to injuries on the job.</p> <p>a. perform artificial respiration.</p> <p>b. test for shock.</p>		

Notes:

Topic III: INSTALLATION OF RESIDENTIAL WIRING

Generalization C: The function of residential wiring is to provide proper, safe and sufficient power distribution in the home so that it can be efficiently utilized.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Installation - Code		The student will: a. explain the need for the Code and demonstrate his knowledge of the contents of the code book by finding sections requested by the teacher. b. given the plan of a home, "wire" it according to the regulations governing such and pass inspection by a government inspector.	Discussion with aid of "information sheets" on sections 0, 2, 4, 6, 8, 10, 12, 16 and 30 of the Code.	
2. Planning - Symbols are the shorthand of drafting - Blueprints are the medium by which ideas become practical - Orthographic Drawing		a. use the electrical symbols, especially those used on residential plans: lights, outlets of various sorts, home-runs. b. identify and interpret. c. plan, lay out and draw side, top and front views of objects.	Starting with simple circuits students would progress through a series of worksheets to more "complex" circuits. Lecture/Discussion	
3. Tools		a. given a tool, describe where it is used, how it is maintained, how it is adjusted and safely used.	Lecture/Discussion. Films by Gen. Motors.	

Notes:

Topic III: INSTALLATION OF RESIDENTIAL WIRING (Continued)

Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>4. Power Outlets</p> <ul style="list-style-type: none"> <li>- Voltage and current ratings are prescribed by the CEC for wire sizes, circuits, and components.</li> <li>- High usage areas require special circuit arrangements.</li> </ul>		<p>The student will:</p> <ul style="list-style-type: none"> <li>b. use special handtools and trouble shooting equipment with some proficiency.</li> <li>c. show proper and safe use of equipment such as ladders, stud guns and various electrical tools.</li> <li>a. given an electrical component, identify its various ratings.</li> <li>b. lay out circuit arrangements according to Code in such areas as kitchen, utility area, and dining room.</li> <li>c. plan approved alternatives to the above, such as:               <ul style="list-style-type: none"> <li>- loan centres</li> <li>- split receptacles</li> <li>- ganging of receptacles.</li> </ul> </li> </ul>	<p>Exercises can be provided so that a student will gain first hand knowledge on how to use and apply them in residential wiring. (Tables 2 &amp; 3)</p> <p>Lecture/Demonstration. Films.(Table 4.)</p> <p>Discussion/Demonstration. Use actual components and refer to the appropriate code ruling to determine its overall characteristics.</p>	

Notes:

Topic III: INSTALLATION OF RESIDENTIAL WIRING (Continued)Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>- Special wiring is a requirement for high-wattage appliances such as: range, dryer, and dishwasher, etc.</p> <p>5. Lighting</p> <p>- Wiring of fixtures must allow for characteristics of fixture.</p> <p>- Fluorescent fixtures should be used where a high, even concentration of light is desired.</p>		<p>The student will:</p> <p>d. given the appliance rating in watts, translate this in terms of wire size, breaker size, etc. according to Code.</p> <p>e. prepare a material list for a general installation.</p> <p>The student will explain in detail Section 30 of the C.E.C.</p> <p>a. explain the features of fluorescent lighting by being familiar with its operation and associated characteristics.</p>	<p>Lecture/Discussion. In lieu of practical work, worksheet could be used.</p> <p>Discussion on Sect. 30, C.E.C.</p> <p>Students can be given the opportunity to install a special fixture according to the rules of the Code. e.g. Use of armored cable, heat resistant wire, etc.</p> <p>Lecture/Discussion. Films from Gen. Electric. A fluorescent fixture could be examined and wired.</p> <p>A comparison between incandescent and fluorescent lighting taking into</p>	

Notes:



Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>6. Services</p> <p>- Breaker: provide over-current protection.</p>		<p>The student will:</p> <p>a. sketch a complete service that will meet Code requirements.</p> <p>b. explain what protection is provided by:</p> <ul style="list-style-type: none"> <li>- main breaker</li> <li>- branch circuit breakers</li> </ul>	<p>account candlepowers, lumens, watts, etc., could be made and highlighted by the use of light sensitive measuring equipment.</p> <p>Lecture/Discussion/Demonstration. Activities to include, if possible, work on actual service equipment. Referral to Sect. #6 of the C.E.C. and Tables 2 &amp; 5 is a necessary part of this activity.</p> <p>Discussion/Demonstration. Students should be able to work on a panel, i.e. installation wiring and tying in breakers.</p>	
<p>7. Special Circuits</p>		<p>a. write an essay on how transformers are installed and why they are used.</p>	<p>Discussion. Students can be given the opportunity to work with transformers and realize at the same time why they are used in bell circuits, remote control circuits, and furnace control circuits.</p>	

Notes:

Topic III: INSTALLATION OF RESIDENTIAL WIRING (Continued)Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
8. Garages		<p>The student will:</p> <p>a. given a garage layout, be able to wire it internally and service it by either:</p> <ul style="list-style-type: none"> <li>- underground or overhead feeder.</li> </ul>	<p>Lecture/Demonstration. The student can be given a lot layout showing a house and garage location and be required to draw in the wiring circuits.</p>	

Notes:

Generalization D: Efficient and safe operation of the residential wiring system depends on regular and effective maintenance.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. Gas Furnace Heating</p> <p>- All heating systems must be provided with an internal protection circuit.</p>		<p>The student will:</p> <p>a. explain how furnace electrical components perform their functions and how they are used as control devices in either the primary or secondary circuit.</p> <p>b. draw and explain the operation of a control circuit.</p>	<p>Lecture/Demonstration. Students can be given exercises and practice work with the components (maintenance of motors)</p> <p>Lecture/Discussion with pertinent information from Sect. #62, C.E.C. of at least <u>one</u> heating system.</p>	
<p>2. Electric Heating</p>		<p>a. describe the various types of electrical heating e.g.</p> <p>- baseboard - underground</p>	<p>Discussion with application of Section #62, C.E.C.</p>	
<p>3. Rewiring</p> <p>- Additional Outlets</p>		<p>a. fish in an additional outlet without major damage to a partition or ceiling.</p>	<p>Discussion. Student can be assigned to fish in an outlet in a mock-up.</p>	

Notes:

Topic V: MANAGEMENT PRACTICES

Generalization E: An understanding of relationships between employer and employee, unions and management and regulations that bind both is essential to help all concerned meet their responsibilities.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. Business Organization &amp; Procedures</p>		<p>The student will:</p> <ul style="list-style-type: none"> <li>a. discuss in an intelligent manner different types of businesses, laws that regulate them and some advantages/disadvantages of each.</li> <li>b. discuss the methods of invoicing, stock taking, billing, collecting tardy accounts.</li> <li>c. Workmen's Compensation responsibilities.</li> </ul>	<p>Lecture/Discussion about the information and running of companies in Alberta. Govt. of Alberta pamphlets can be obtained on this.</p> <p>Discussion. Develop with examples.</p>	
<p>2. Bidding on Work</p>		<ul style="list-style-type: none"> <li>a. given a residential blueprint, submit an accurate bid.</li> </ul>		
<p>3. Employee Concerns</p> <p>The interests of the worker are protected by various means. - Legislation.</p> <p>- Employee Groups</p>		<ul style="list-style-type: none"> <li>a. discuss the responsibilities in contributions towards; U.I.C., pension, medical.</li> <li>b. discuss the various employee groups, advantages and disadvantages and his expectations in his area of domicile.</li> </ul>	<p>Discussion.</p>	

Notes:

VI. RELATED MECHANICS

5. Related Mechanics 32A

(Machine Shop)

## INTRODUCTION

Machine Shop for Related Mechanics is the first of several modules designed to help the student become knowledgeable in the basic operation of tools and machine equipment. The course is written so that application of the concepts can be made by the teacher to the best advantage of the class.

Should more depth of content be desirable, teachers may select additional content from Machine Shop 22A and B in the Construction and Fabrication series.

### I. OBJECTIVES

The objectives of Related Mechanics Machine Shop are:

1. to give students an understanding of the role of the machinist in industrial society.
2. to introduce the students to the safe use of tools and acceptable procedures basic to the machinist trade.

### II. CONTENT SUMMARY

1. Safety
2. Measurement and layout
3. Tool Processes
  - removal of material by mechanical means
  - power saw
  - lathe
  - shaper
  - drill press
  - grinder
4. Metal characteristics
  - identification
  - treatment
  - application

## III. REFERENCES

- \* Hallet, Fred H. *Machine Shop Theory Practice*. (Revised edition). MacMillan Co. of Canada, Toronto.
- Krar, S.F. and J.E. St. Amand. *Machine Shop Training*. McGraw-Hill Co. of Canada Ltd., Toronto.
- McCarthy-Smith. *Machine Tool Technology*. McKnight & McKnight Publishers.
- Feirer and Tatro. *Machine Tool Metal Working*. McGraw-Hill Publishers.
- Walker, John R. *Machining Fundamentals*. Goodheart-Wilcox Publishers.
- \* Most important

## IV. CONTENT

Generalizations, concepts and behavioural objectives are outlined on the following pages. Teachers are expected to develop additional behavioural objectives and activities to supplement the identified content and maintain relevancy.

Topic I: SAFETY CONSCIOUSNESSMajor: Related  
MechanicsGeneralization A: A knowledge and practice of safety is an essential consideration in all shop activities.Course: 32A (Machine  
Shop)

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Unsafe Act	2 hrs.	The student will:  a. list the consequences of unsafe acts in Machine Shop as they relate particularly to:  - lifting - eye safety - machine safety - safe clothing - electrical wires	Lectures, posters, movies, slides, guest speakers for unsafe acts.	
2. Unsafe Condition		a. discuss how to identify conditions which could lead to injuries on the job.  b. list benefits available under the Workmen's Compensation Act and insurance plans.	Maintain tools and machines in proper working condition and make sure that protective equipment is always in place and/or immediately available.  Analyze a machine operation for unsafe conditions.	

Notes:





Generalization C: Materials are shaped by removing, combining and forming using hand and power tools.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. Removal by Mechanical Means</p> <ul style="list-style-type: none"> <li>- Shearing - Hand Tools</li> <li>- Power Tools</li> </ul>		<p>The student will:</p> <ul style="list-style-type: none"> <li>a. remove material safely using the following:                             <ul style="list-style-type: none"> <li>- scriber</li> <li>- hack saw</li> <li>- chisel</li> <li>- file</li> <li>- tap</li> <li>- die</li> <li>- abrasive cloth</li> </ul> </li> <li>b. remove material safely using the following:                             <ul style="list-style-type: none"> <li>- power saw</li> <li>- lathe                                     <ul style="list-style-type: none"> <li>- facing</li> <li>- turning</li> <li>- threading (dies)</li> <li>- taper turning</li> <li>- 3 and 4 jaw chucks</li> <li>- centres</li> <li>- other lathe operations</li> </ul> </li> <li>- shaper                                     <ul style="list-style-type: none"> <li>- flat surfaces</li> <li>- inclined surfaces</li> <li>- contoured surfaces</li> </ul> </li> </ul> </li> </ul>	<p>Centre punch, round ball, 3-step shaft to specifications.</p>	

Notes:

Generalization

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
		<ul style="list-style-type: none"> <li>- drill press</li> <li>- centre drill</li> <li>- twist drill</li> <li>- countersink</li> <li>- counterbore</li> <li>- reamer</li> <li>- drill gauge</li> <li>- grinder</li> <li>- freehand grinding</li> </ul>	<p>Drilling, etc. - drawing drill over flowering surface.</p> <p>Sharpen tool bits, sharpen chisels.</p>	

Notes:

Generalization D: Different metals have special characteristics suitable for specific applications.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. Identification</p> <p>2. Treatment</p> <p>3. Application</p>	<p>2 hrs.</p>	<p>The student will:</p> <p>a. identify various metals by:</p> <ul style="list-style-type: none"> <li>- color</li> <li>- density</li> <li>- magnetic properties</li> <li>- hardness (file test)</li> <li>- spark test</li> </ul> <p>a. harden and temper a product machined from heat-treatable steel (i.e. high carbon or special alloy).</p> <p>a. describe the circumstances where steels of different hardness and strength are required.</p>		

Notes:

VI. RELATED MECHANICS

6. Related Mechanics 32B

(Welding)

## INTRODUCTION

Welding has become an integral part of activities of the farm and shop. This welding course will provide the student with a basic understanding of what the Welding and Fabrication trades consist of.

### I. OBJECTIVES

The objectives of Related Mechanics Welding are to:

1. give students an understanding of the role of the welder in industrial society.
2. introduce the students to the safe use of tools and acceptable procedures basic to the welding trade.

### II. CONTENT SUMMARY

1. Career Field Study
2. Trade Study
3. Safety in the Welding Shop
4. Measurement
5. Tool Processes
6. Joining and Separating Metals
7. Metal Removal
8. Fabrication

This course in Welding should be directed to the type of welding jobs found relevant to the needs of the location. In a farming community, student activities should be representative of the occupations found there.

### III. REFERENCES

- \* Kennedy, Gower A. *Welding Technology*. Howard W. Sams & Co. Inc., 1974.
- \* Pender, J.A. *Welding*. McGraw-Hill Publishing Company of Canada.
- \* Tuttle, C.A. *Fundamentals of Oxy-Acetylene and Arc Welding*. Pitman (Canada) Ltd.  
Griffin & Roden. *Basic Oxy-Acetylene, Basic Arc Welding*. Delmar.  
Lincoln. *Lessons in Arc Welding*. Lincoln Electric Co. Ltd.
- \* Most Useful.

### IV. CONTENT

Generalizations, concepts and behavioural objectives are outlined on the following pages. Teachers are expected to develop additional behavioural objectives and activities to supplement the identified content and maintain relevancy.

Topic I: CAREER FIELD STUDY

Major: Related  
Mechanics

Generalization A: There are many occupations within and related to the career field of Construction and Fabrication.

Course: 32B  
(Welding)

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Career Field Occupations	3 hrs.	The student will: a. list the various occupations existent in the career field and their basic entry requirements. b. discuss the various courses offered within the school system.	Lectures, field trips, speakers, films, T.V.	
2. Related Occupations		As above.		
3. Employment		a. survey the employment opportunities in a chosen trade, locally, regionally and nationally.		

Notes:



Generalization B: The welder fulfills an important function in our modern industrial society.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>Certification</p>	<p>2 hrs.</p>	<p>The student will:</p> <p>a. discuss the different classes of welder certificates:</p> <ul style="list-style-type: none"> <li>- 2nd class</li> <li>- Journeyman</li> <li>- Provisional B</li> <li>- B pressure</li> <li>- A certificate</li> <li>- Others</li> </ul> <p>as certified by the provincial government.</p>	<p>Apprenticeship or Tradesman Qualification Board.</p>	

Notes:



Generalization D: Measurement and layout are essential to the proper manufacture and repair of most products.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. Measuring Units</p> <p>2. Measuring Instruments</p> <p>3. Lay-out Methodology</p>	<p>3 hrs.</p>	<p>The student will:</p> <p>a. read a rule</p> <p>a. use:</p> <ul style="list-style-type: none"> <li>- rule</li> <li>- a square - sliding Tee-Combination</li> <li>- caliper</li> <li>- micrometers</li> </ul> <p>a. use acceptable techniques:</p> <ul style="list-style-type: none"> <li>- to square</li> <li>- to allow for thickness</li> <li>- to cope angle irons</li> <li>- basic "spreadouts" (a box)</li> </ul> <p>b. use the basic instruments:</p> <ul style="list-style-type: none"> <li>- scratch awl</li> <li>- punches</li> <li>- dividers</li> <li>- marking chalk</li> </ul>		

Notes:

Generalization E: Metals may be joined by the heat produced from an electric arc.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
<p>1. Safety</p> <p>2. Terminology</p> <p>3. Machine Types</p> <p>4. Electrodes</p> <p>5. Cohesion</p> <p>- plate square butt welding technique</p>		<p>The student will:</p> <p>a. demonstrate verbally an understanding of the electrical terms: voltage, amperage, A.C. D.C., rectifiers, diodes.</p> <p>a. describe the different types of welding machines: A.C. transformers, Alternators, D.C. Generators, AC/DC Rectifiers - other types.</p> <p>b. explain the advantages and disadvantages of each of the above machines.</p> <p>a. select and tell why one electrode will do a particular job best.</p> <p>a. describe the A.W.S. electrode classification.</p> <p>b. fusion weld with E-6010, E-6011, E-6013, E-7014, E-7024 and E-7018 electrodes the following joints and welds: Butt weld, Lap weld, Corner Weld and Fillet weld. These welds will be in the flat posi-</p>	<p>Demonstrations, Films, other A.V. materials.</p>	

Notes:

Generalization E: Metals may be joined by the heat produced from an electric arc.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
	40 hrs.	<p>tion progressing to out-of-position depending on the speed of skill acquisition and the particular electrodes being used.</p> <p>c. demonstrate welds in the flat, vertical and horizontal position.</p>		

Notes:

Generalization F: The oxy-acetylene process is used for joining and separating metals.

Concept and Sub-Concepts	Approx. Time	Behavioural Objectives	Activities or Jobs	Resources
1. Safety	30 hrs.	The student will: a. list all the pieces of oxy-acetylene outfit, the purpose of each and how to safely operate each. b. demonstrate the proper start-up and shut-down of an oxy-acetylene outfit.	Practice safe torch manipulation.	
2. Cohesion		a. fusion weld several different gauges of material - steel, in the common joints and positions Tee, Butt, Lap and Outside Corner in the flat, horizontal and vertical positions. b. oxy-acetylene weld on practice material.		
3. Flame Cutting		a. demonstrate the correct cutting position and techniques for different shapes.		
4. Forming		a. heat and bend iron to specified lengths and angles.		

Notes:







VII. RELATED MECHANICS

7. Related Mechanics 32C



## RELATED MECHANICS 32C

The last module of the Related Mechanics sequence is open to students who have completed 30 credits or six modules in the major.

The 125 hours of instruction time available in this module may be used to:

- (a) provide greater depth to a module taken previously. Individual students, groups of students or whole classes may elect to study an area in more detail to develop more skills. This in-depth study could be an expansion on any of the modules previously completed in the sequence such as; Automotives, Building Construction, Electricity, Welding or Machine Shop.
- (b) engage in actual work through a program coordinated by the Related Mechanics teacher and under a qualified person on the job.

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